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The Relationship Between Nutritional Knowledge and Attitudes and Energy Adequacy Levels Among Futsal Club Members

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ABSTRACT

Futsal is a high-intensity sport that requires adequate energy intake to support training performance, recovery, and overall athletic development. Nutritional knowledge and nutritional attitudes are considered important factors influencing dietary behavior and energy adequacy among adolescent athletes. However, the extent to which these factors are associated with energy adequacy levels among school-based futsal players remains unclear. Therefore, this study aimed to determine the relationship between nutritional knowledge and nutritional attitudes with energy adequacy levels among members of the SMAN 2 Makassar futsal club. This study employed a quantitative approach with a cross-sectional design. The population consisted of all members of the SMAN 2 Makassar futsal club, totaling 40 athletes, with 37 respondents meeting the study criteria and participating in data collection. Data were obtained using a nutritional knowledge questionnaire, a nutritional attitude questionnaire, and a two-day 24-hour food recall to assess energy intake. Data analysis was performed using the Fisher Exact test with IBM SPSS version 22. The results showed that most respondents had moderate nutritional knowledge (45.9%) and moderate nutritional attitudes (56.8%). Regarding energy adequacy, 51.4% of respondents were classified as having low energy adequacy levels, while 48.6% had adequate energy intake. Statistical analysis revealed no significant relationship between nutritional knowledge and energy adequacy levels (p = 0.306), as well as no significant relationship between nutritional attitudes and energy adequacy levels (p = 0.838). In conclusion, nutritional knowledge and nutritional attitudes were not significantly associated with energy adequacy levels among futsal club members at SMAN 2 Makassar. These findings suggest that factors beyond knowledge and attitudes, such as eating habits, food availability, lifestyle, and training schedules, may play a more substantial role in determining energy adequacy among adolescent athletes.

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INTRODUCTION

Physical activity is an essential component of human health and plays a critical role in maintaining physiological function, preventing chronic diseases, and enhancing

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overall quality of life. Among adolescents, participation in organized sports has increased substantially due to growing awareness of the importance of physical fitness and athletic achievement (World Health Organization, 2022). One of the most popular sports among Indonesian adolescents is futsal, a modified form of football played by two teams consisting of five players on a smaller court, requiring high-intensity intermittent movements, agility, speed, technical skills, and teamwork (Is & Hariansyah, 2020). Because of its physiological demands, futsal players require adequate nutritional intake to support training adaptation, recovery, and competitive performance (Thapa et al., 2023).

Nutrition is a fundamental determinant of athletic performance. Appropriate dietary practices enable athletes to maintain energy balance, optimize body composition, improve endurance, and reduce the risk of injury and fatigue (Thomas et al., 2016). However, adolescents often experience nutritional problems due to inadequate dietary habits, irregular meal patterns, excessive consumption of processed foods, and insufficient understanding of balanced nutrition (Penggalih et al., 2023). These issues become more concerning among young athletes because nutritional deficiencies can directly affect physical performance and long-term health outcomes.

Nutritional knowledge represents an individual's understanding of food sources, nutrient functions, dietary recommendations, and the relationship between nutrition and health (Aulia, 2021). Adequate nutritional knowledge is expected to guide adolescents in selecting healthy foods and making informed dietary decisions. Previous studies have shown that individuals with higher nutritional knowledge tend to demonstrate healthier eating behaviors and better dietary quality (Mustikasari et al., 2022). Conversely, limited nutritional knowledge often contributes to poor dietary choices and inadequate nutrient intake.

In addition to knowledge, nutritional attitudes play an important role in shaping eating behaviors. Attitudes reflect individuals' beliefs, perceptions, and willingness to adopt healthy dietary practices. Positive attitudes toward nutrition encourage healthy food selection and compliance with dietary recommendations, whereas negative attitudes may hinder the implementation of healthy eating habits (Utami et al., 2020). Therefore, nutritional knowledge and attitudes are considered interconnected determinants of dietary behavior and energy intake adequacy.

Energy adequacy is particularly important for futsal athletes due to the high-intensity nature of the sport. Futsal involves repeated sprints, rapid directional changes, explosive movements, and sustained physical exertion that require substantial energy expenditure (Aliyah, 2021). According to the Indonesian Ministry of Health (2021), athletes participating in high-intensity sports require adequate intake of carbohydrates, proteins, and fats to maintain energy balance and support performance. Insufficient energy intake may result in decreased endurance, impaired recovery, reduced concentration, and increased risk of injury (Afni & Al Faiqoh, 2024).

Preliminary observations conducted among members of the SMAN 2 Makassar Futsal Club revealed that many athletes frequently skip meals before training sessions or

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consume nutritionally inadequate foods. Interviews with coaches indicated that academic commitments, limited nutritional awareness, and poor dietary habits contribute to insufficient energy intake among athletes. These conditions may negatively affect training quality, physical performance, and overall athletic development. Therefore, investigating factors associated with energy adequacy among adolescent futsal players becomes an important research priority.

Recent studies have increasingly emphasized the importance of sports nutrition education among adolescent athletes. Research conducted by Penggalih et al. (2023) demonstrated that nutritional education significantly improves nutritional knowledge and dietary behavior among young athletes. Similarly, Spronk et al. (2019) reported that athletes with higher nutrition knowledge scores tend to exhibit healthier eating patterns and better compliance with sports nutrition recommendations.

Several studies have examined the relationship between nutritional knowledge and dietary intake. Trakman et al. (2018) found that nutritional knowledge positively influences food choices and nutrient consumption among athletes. Likewise, Heikkilä et al. (2019) reported that greater nutrition literacy contributes to improved dietary quality and adequate nutrient intake among adolescents. These findings suggest that knowledge serves as a critical foundation for establishing healthy eating behaviors.

Research on nutritional attitudes has also demonstrated significant associations with dietary practices. Mustikasari et al. (2022) found that positive attitudes toward balanced nutrition were associated with healthier eating patterns among Indonesian adolescents. Similar findings were reported by Rahman et al. (2021), who observed that favorable nutritional attitudes significantly influenced dietary compliance and food selection behavior.

Studies focusing specifically on athletes have shown that inadequate energy intake remains a common concern. Thapa et al. (2023) reported that many adolescent athletes fail to meet recommended energy requirements despite engaging in regular training. Research conducted by Jenner et al. (2019) revealed that insufficient energy availability negatively affects athletic performance, recovery, and physiological adaptation. Furthermore, Mountjoy et al. (2018) highlighted that low energy availability is associated with impaired health and reduced sports performance among young athletes.

Within the Indonesian context, studies investigating nutrition among student athletes remain relatively limited. Existing research has primarily focused on nutritional status, dietary patterns, and body composition, while fewer studies have explored the combined influence of nutritional knowledge and attitudes on energy adequacy levels among adolescent athletes.

Although previous studies have established relationships between nutritional knowledge, attitudes, and dietary behavior, several gaps remain unresolved. First, most studies have examined nutritional knowledge and attitudes independently rather than simultaneously assessing their combined association with energy adequacy levels. Consequently, the integrated contribution of cognitive and affective nutritional factors to energy intake remains insufficiently understood. Second, existing studies

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predominantly involve general adolescent populations rather than athletes participating in high-intensity sports such as futsal. Because athletes have substantially higher energy requirements compared with non-athletes, findings from general adolescent populations may not be directly applicable to sports settings. Third, limited evidence exists regarding the nutritional behavior of Indonesian high school futsal players, particularly in South Sulawesi. Most available studies focus on professional athletes, university students, or broader adolescent populations, leaving a lack of localized evidence concerning school-based sports clubs. Fourth, few studies have investigated nutritional knowledge, attitudes, and energy adequacy simultaneously among adolescent futsal athletes within the Indonesian educational environment. This gap highlights the need for empirical research that provides a comprehensive understanding of nutritional determinants affecting young athletes' energy sufficiency.

Based on these gaps, this study aims to determine the relationship between nutritional knowledge and nutritional attitudes with energy adequacy levels among members of the SMAN 2 Makassar Futsal Club. Specifically, the study seeks to examine whether nutritional knowledge and attitudes are significantly associated with the ability of adolescent athletes to meet their daily energy requirements. The novelty of this study lies in its integrated analysis of nutritional knowledge and nutritional attitudes as simultaneous predictors of energy adequacy among adolescent futsal athletes. Unlike previous studies that focus on general adolescents or examine nutritional factors separately, this research specifically targets high school futsal players who experience elevated energy demands due to intensive physical activity. Furthermore, the study provides context-specific evidence from South Sulawesi, contributing valuable insights for developing nutrition education programs and sports nutrition interventions within school-based athletic environments.

In addition, the findings are expected to support coaches, teachers, nutritionists, and educational institutions in designing evidence-based nutritional strategies that enhance athletes' dietary behaviors, energy adequacy, training adaptation, and sports performance. In conclusion, adequate nutritional knowledge and positive nutritional attitudes are important determinants of healthy dietary practices and sufficient energy intake among adolescent athletes. Considering the high physiological demands of futsal, understanding the relationship between nutritional factors and energy adequacy is crucial for optimizing athletic performance and health. Therefore, this study contributes to filling existing research gaps by providing empirical evidence regarding the relationship between nutritional knowledge, nutritional attitudes, and energy adequacy levels among futsal club members at SMAN 2 Makassar.

METHODS

This study employed a quantitative research approach with a cross-sectional design to examine the relationship between nutritional knowledge, nutritional attitudes, and energy adequacy levels among members of the SMAN 2 Makassar futsal club. A cross-sectional design was selected because it enables researchers to assess the

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relationships among variables simultaneously at a single point in time, making it suitable for identifying associations between nutritional factors and dietary outcomes in adolescent populations (Setia, 2016). This design has been widely utilized in sports nutrition research to investigate determinants of dietary intake and nutritional behaviors among young athletes (Trakman et al., 2018; Spronk et al., 2019).

The study was conducted at SMAN 2 Makassar, South Sulawesi, Indonesia, from October to November 2025. The target population consisted of all active members of the school's futsal club, totaling 40 athletes. Considering the relatively small population size and the objective of obtaining comprehensive information from all participants, the study employed a total sampling technique. Total sampling is recommended when the population size is manageable and when researchers aim to minimize sampling bias while maximizing representativeness (Etikan & Bala, 2017). Consequently, all 40 futsal athletes were included as research participants.

Data collection was carried out using survey and dietary assessment techniques. Three primary instruments were utilized: a nutritional knowledge questionnaire, a nutritional attitude questionnaire, and a 24-hour food recall form. The nutritional knowledge questionnaire consisted of multiple-choice items designed to assess respondents' understanding of balanced nutrition principles, nutrient functions, food sources, hydration, meal timing, and sports nutrition concepts. Previous studies have demonstrated that nutritional knowledge is a significant determinant of dietary behavior and food choices among adolescent athletes (Penggalih et al., 2023; Heikkilä et al., 2019). Therefore, evaluating athletes' knowledge levels was considered essential for understanding their nutritional practices.

Nutritional attitudes were assessed using a structured Likert-scale questionnaire ranging from strongly disagree to strongly agree. The instrument measured participants' perceptions, beliefs, and attitudes toward healthy eating, balanced nutrition, meal planning, and dietary practices supporting sports performance. Positive nutritional attitudes have been consistently associated with healthier eating behaviors and greater compliance with dietary recommendations among adolescents and athletes (Mustikasari et al., 2022; Rahman et al., 2021). Before administration, both questionnaires underwent content validation by experts in nutrition and sports science to ensure relevance, clarity, and appropriateness for adolescent athletes.

The level of energy adequacy was assessed using a 24-hour dietary recall conducted on two non-consecutive days, including one weekday and one training day. Participants were asked to report all foods and beverages consumed within the previous 24 hours, including portion sizes, meal frequency, and snack consumption. The multiple-pass recall method was applied to improve the accuracy and completeness of dietary reporting (Thompson & Subar, 2017). Dietary assessment through repeated 24-hour recalls is widely recognized as a valid approach for estimating habitual energy intake among adolescents and athletes (Shim et al., 2014).

The food recall data were subsequently entered into nutritional analysis software to calculate total daily energy intake. The calculated energy intake values were then

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compared with the recommended energy requirements for adolescent athletes based on national sports nutrition guidelines and individual body weight considerations (Ministry of Health of the Republic of Indonesia, 2021). Energy adequacy levels were expressed as percentages of recommended dietary requirements and categorized according to established nutritional assessment standards (Gibson, 2023).

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 27. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to summarize participant characteristics and study variables. Prior to inferential analysis, data normality was assessed using the Shapiro–Wilk test. To examine the relationships between nutritional knowledge, nutritional attitudes, and energy adequacy levels, Pearson Product-Moment correlation analysis was employed for normally distributed data, whereas Spearman rank correlation analysis was applied when normality assumptions were not met (Field, 2022). Statistical significance was established at $p < .05$. Through this analytical approach, the study aimed to provide empirical evidence regarding the extent to which nutritional knowledge and attitudes contribute to energy adequacy among adolescent futsal athletes, thereby supporting the development of evidence-based nutrition education programs in school sports settings.

RESULTS AND DISCUSSION

Result

This study aimed to determine the relationship between nutritional knowledge and nutritional attitudes with energy adequacy levels among members of the SMAN 2 Makassar Futsal Club. A total of 37 athletes participated in the study. Data were collected using nutritional knowledge questionnaires, nutritional attitude questionnaires, and two-day 24-hour food recalls. The results are presented descriptively and analytically as follows.

Distribution of Nutritional Knowledge

The distribution of respondents based on nutritional knowledge levels is presented in Table 1.

Table 1.
Distribution of Nutritional Knowledge Among Futsal Club Members

Nutritional Knowledge	n	%
Poor	15	40.5
Moderate	17	45.9
Good	5	13.6
Total	**37**	**100.0**

Table 1 shows that most respondents had a **moderate level of nutritional knowledge** (45.9%), followed by those with poor nutritional knowledge (40.5%). Only 13.6% of respondents demonstrated good nutritional knowledge. These findings indicate that the majority of futsal athletes possessed limited understanding of balanced nutrition, nutrient functions, and sports nutrition requirements.

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Distribution of Nutritional Attitudes

The distribution of respondents according to nutritional attitudes is shown in Table 2.

Table 2.
Distribution of Nutritional Attitudes Among Futsal Club Members

Nutritional Attitude	n	%
Poor	12	32.4
Moderate	21	56.8
Good	4	10.8
Total	**37**	**100.0**

Table 2 indicates that more than half of the respondents (56.8%) exhibited a moderate nutritional attitude. Meanwhile, 32.4% demonstrated poor nutritional attitudes, and only 10.8% had good attitudes toward nutrition. This suggests that although athletes generally recognized the importance of nutrition, positive attitudes toward consistent healthy eating practices were still relatively limited.

Distribution of Energy Adequacy Levels

The distribution of respondents according to energy adequacy levels is presented in Table 3.

Table 3.
Distribution of Energy Adequacy Levels

Energy Adequacy Level	n	%
Low	19	51.4
Adequate	18	48.6
Total	**37**	**100.0**

The findings reveal that 51.4% of respondents had low energy adequacy levels, while 48.6% achieved adequate energy intake. These results suggest that more than half of the athletes failed to meet their daily energy requirements despite participating in regular futsal training activities.

Relationship Between Nutritional Knowledge and Energy Adequacy Levels

The association between nutritional knowledge and energy adequacy levels was analyzed using the Chi-square test and is presented in Table 4.

Table 4.
Relationship Between Nutritional Knowledge and Energy Adequacy Levels

Nutritional Knowledge	Low Energy Adequacy n (%)	Adequate Energy Adequacy n (%)	Total
Poor	8 (53.3)	7 (46.7)	15
Moderate	10 (58.8)	7 (41.2)	17
Good	1 (20.0)	4 (80.0)	5
Total	**19**	**18**	**37**

p-value = 0.306

The results indicate that respondents with good nutritional knowledge tended to have better energy adequacy levels, with 80.0% achieving adequate energy intake. In contrast, respondents with poor and moderate nutritional knowledge showed higher proportions of low energy adequacy levels, at 53.3% and 58.8%, respectively.

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However, statistical analysis revealed a p-value of 0.306 ($p > 0.05$), indicating that there was no statistically significant relationship between nutritional knowledge and energy adequacy levels among futsal club members of SMAN 2 Makassar. Therefore, the null hypothesis (H_0) was accepted, suggesting that nutritional knowledge alone was not significantly associated with athletes' ability to meet their daily energy requirements.

Figure 4.
Nutritional Knowledge and Energy Adequacy Levels

Knowledge Level	Low (%)	Adequate (%)
Poor	53.3	46.7
Moderate	58.8	41.2
Good	20.0	80.0

Relationship Between Nutritional Attitudes and Energy Adequacy Levels

The relationship between nutritional attitudes and energy adequacy levels was also analyzed using the Chi-square test. The results are shown in Table 5.

Table 5.
Relationship Between Nutritional Attitudes and Energy Adequacy Levels

Nutritional Attitude	Low Energy Adequacy n (%)	Adequate Energy Adequacy n (%)	Total
Poor	7 (58.3)	5 (41.7)	12
Moderate	10 (47.6)	11 (52.4)	21
Good	2 (50.0)	2 (50.0)	4
Total	**19**	**18**	**37**

p-value = 0.838

Table 5 shows that respondents with moderate nutritional attitudes demonstrated slightly better energy adequacy levels (52.4%) compared to those with poor attitudes (41.7%). However, the differences among categories were relatively small.

The Chi-square analysis produced a p-value of 0.838 ($p > 0.05$), indicating that there was no statistically significant relationship between nutritional attitudes and energy adequacy levels among futsal athletes. Consequently, the null hypothesis (H_0) was accepted, suggesting that nutritional attitudes did not significantly influence whether athletes achieved adequate daily energy intake.

Table 6.
Nutritional Attitudes and Energy Adequacy Levels

Attitude Level	Low (%)	Adequate (%)
Poor	58.3	41.7
Moderate	47.6	52.4
Good	50.0	50.0

Overall, the descriptive analysis showed that most futsal athletes possessed moderate levels of nutritional knowledge (45.9%) and nutritional attitudes (56.8%). More than half of the respondents (51.4%) had low energy adequacy levels, indicating insufficient daily energy intake. Although athletes with good nutritional knowledge tended to exhibit higher proportions of adequate energy intake (80.0%), statistical testing demonstrated that nutritional knowledge was not significantly associated with energy adequacy levels ($p = 0.306$). Similarly, nutritional attitudes showed no significant

relationship with energy adequacy levels (p = 0.838). These findings suggest that factors beyond knowledge and attitudes, such as food availability, socioeconomic status, meal frequency, parental influence, training schedules, and lifestyle habits, may play a greater role in determining energy adequacy among adolescent futsal athletes at SMAN 2 Makassar.

Discussion

The present study investigated the relationship between nutritional knowledge, nutritional attitudes, and energy adequacy levels among members of the SMAN 2 Makassar futsal club. The findings revealed that most respondents possessed moderate levels of nutritional knowledge (45.9%) and nutritional attitudes (56.8%), while more than half of the participants (51.4%) exhibited inadequate energy intake. Furthermore, statistical analysis demonstrated that neither nutritional knowledge (p = 0.306) nor nutritional attitudes (p = 0.838) were significantly associated with energy adequacy levels.

The predominance of moderate nutritional knowledge among respondents suggests that adolescent futsal players have acquired a basic understanding of nutrition concepts, balanced diets, and healthy eating practices. This finding is consistent with previous studies indicating that adolescents generally obtain nutritional information from schools, social media, sports coaches, and health promotion programs (Penggalih et al., 2023; Mustikasari et al., 2022). In recent years, the increasing availability of nutrition-related information through digital platforms has improved awareness among young athletes regarding the importance of healthy eating and sports nutrition (Thomas et al., 2016; Trakman et al., 2018). However, possessing nutritional knowledge does not necessarily guarantee the adoption of healthy dietary behaviors. Spronk et al. (2019) emphasized that knowledge functions as a prerequisite for behavior change but is insufficient by itself to modify eating habits. Similar conclusions were reported by Heikkilä et al. (2019), who found that adolescents with adequate nutritional knowledge did not always demonstrate appropriate dietary intake.

The discrepancy between nutritional knowledge and actual dietary behavior observed in this study may be explained by the multidimensional nature of food choices. Adolescent athletes frequently encounter barriers such as limited food availability, time constraints, peer influence, family eating patterns, and financial limitations (Devlin et al., 2017; Bentley et al., 2020). Consequently, even individuals with adequate nutritional knowledge may struggle to implement healthy dietary practices consistently. This phenomenon supports the Social Cognitive Theory proposed by Bandura, which highlights the interaction between personal factors, environmental influences, and behavior in determining health-related actions (Luszczynska & Schwarzer, 2015).

The findings also showed that more than half of the respondents had insufficient energy intake. This result is concerning because futsal is classified as a high-intensity intermittent sport requiring substantial energy expenditure. During training and competition, athletes perform repeated sprints, rapid directional changes, accelerations, and decelerations that substantially increase metabolic demands (Naser et al., 2017; Castillo et al., 2021). According to the Indonesian Ministry of Health (2021), adolescent athletes

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require higher daily energy intake than non-athletes to support growth, physical activity, and recovery processes. Similarly, Burke et al. (2021) emphasized that adequate energy availability is fundamental for maintaining athletic performance, physiological adaptation, and long-term health.

The high prevalence of inadequate energy intake identified in this study may be attributable to several factors. Interviews conducted during data collection indicated that some athletes frequently skipped breakfast, delayed meals due to academic activities, or consumed low-energy snacks before training sessions. These findings align with previous research demonstrating that irregular meal patterns and meal skipping are common among adolescents and often contribute to inadequate nutrient intake (Monterrosa et al., 2020; Croll et al., 2019). Breakfast consumption is particularly important for adolescent athletes because it replenishes glycogen stores after overnight fasting and provides energy for daily activities and training sessions (Desbrow et al., 2018).

Another possible explanation relates to family dietary practices. Family environment has consistently been identified as a significant determinant of adolescent eating behavior (Scaglioni et al., 2018; Pearson et al., 2021). Adolescents whose families do not routinely prepare balanced meals or encourage regular eating schedules may develop poor dietary habits that persist despite possessing nutritional knowledge. Additionally, socioeconomic factors may influence food accessibility and dietary quality. Research by Hanson and Connor (2019) demonstrated that household income significantly affects the availability of nutrient-dense foods and overall dietary adequacy among adolescents.

One of the most important findings of this study is the absence of a statistically significant relationship between nutritional knowledge and energy adequacy levels. Although athletes with good nutritional knowledge tended to exhibit higher proportions of adequate energy intake (80.0%), the overall association was not statistically significant. This finding suggests that energy adequacy is influenced by a broader set of determinants beyond cognitive understanding of nutrition. Similar results have been reported in several studies involving adolescent athletes and university students (Abood et al., 2016; Spronk et al., 2019; Zinn et al., 2017). These studies concluded that nutritional knowledge alone is insufficient to predict dietary intake because behavioral implementation is influenced by motivational, environmental, and contextual factors.

The lack of association between nutritional knowledge and energy intake may also reflect the intention-behavior gap frequently observed in health promotion research. According to Ajzen's Theory of Planned Behavior, individuals may possess knowledge and intentions but fail to translate them into actual behaviors due to perceived barriers or lack of behavioral control (McDermott et al., 2015). In the context of adolescent athletes, demanding school schedules, limited food preparation skills, and dependence on parental food choices may hinder the application of nutritional knowledge in daily life.

Similarly, no significant relationship was found between nutritional attitudes and energy adequacy levels. Although most respondents exhibited moderate attitudes toward nutrition, these attitudes did not correspond to significantly better energy intake. This finding is consistent with studies by Rahman et al. (2021), Mustikasari et al. (2022), and

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Heikkilä et al. (2019), which reported that positive attitudes toward nutrition do not always lead to adequate dietary practices. Attitudes represent psychological predispositions toward certain behaviors; however, actual behavior is often influenced by situational constraints and environmental factors (Contento, 2020).

The absence of a significant relationship between nutritional attitudes and energy adequacy may also be explained by the complexity of dietary behavior among adolescents. Food choices are often driven by convenience, taste preferences, social acceptance, and food accessibility rather than nutritional considerations alone (Stok et al., 2018; Reicks et al., 2019). Consequently, adolescents may express positive attitudes toward healthy eating while simultaneously consuming diets that fail to meet recommended energy requirements.

The findings of this study reinforce the understanding that nutritional behavior is a multifactorial phenomenon influenced by interactions among knowledge, attitudes, environmental conditions, social influences, economic status, and lifestyle factors. Therefore, interventions aimed at improving athlete nutrition should extend beyond traditional nutrition education programs. Contemporary evidence suggests that comprehensive strategies incorporating individualized nutrition counseling, parental involvement, meal planning education, behavioral coaching, and continuous dietary monitoring are more effective in improving dietary intake among adolescent athletes (Burke et al., 2021; Penggalih et al., 2023; Thomas et al., 2016).

Overall, this study contributes to the growing body of literature demonstrating that nutritional knowledge and attitudes alone may not adequately explain energy adequacy among adolescent athletes. Future interventions should adopt a holistic approach that addresses both individual and environmental determinants of dietary behavior. Such efforts are essential for ensuring that adolescent futsal players achieve optimal energy intake to support athletic performance, growth, recovery, and long-term health outcomes.

CONCLUSION

This study aimed to determine the relationship between nutritional knowledge and nutritional attitudes with energy adequacy levels among members of the SMAN 2 Makassar Futsal Club. The findings revealed that the majority of respondents possessed moderate levels of nutritional knowledge (45.9%) and nutritional attitudes (56.8%). Despite this relatively satisfactory level of awareness regarding nutrition, more than half of the participants (51.4%) were classified as having inadequate energy intake, indicating that their daily dietary consumption did not meet the energy requirements necessary to support training, recovery, growth, and athletic performance. The results of the Fisher Exact test demonstrated that there was no statistically significant relationship between nutritional knowledge and energy adequacy levels ($p = 0.306$). Likewise, no significant relationship was found between nutritional attitudes and energy adequacy levels ($p = 0.838$). Although respondents with good nutritional knowledge tended to show a higher proportion of adequate energy intake, the association was not strong enough to reach statistical significance. Similarly, positive nutritional attitudes were not consistently

reflected in dietary practices that fulfilled daily energy requirements. These findings suggest that nutritional knowledge and attitudes alone are insufficient predictors of energy adequacy among adolescent futsal athletes. Energy intake is influenced by a complex interaction of factors, including eating habits, meal frequency, food availability, socioeconomic conditions, family support, training schedules, lifestyle behaviors, and environmental influences. Therefore, improving athletes' nutritional status requires a comprehensive approach that extends beyond theoretical nutrition education. In practical terms, schools, coaches, parents, and health professionals should collaborate to implement structured nutrition programs that include nutrition counseling, individualized meal planning, regular dietary monitoring, and practical guidance on healthy eating behaviors. Such interventions may help athletes translate nutritional knowledge into positive dietary practices and achieve adequate energy intake. Ultimately, ensuring optimal energy adequacy is essential for supporting physical performance, enhancing recovery, promoting healthy growth and development, and maximizing the long-term athletic potential of adolescent futsal players.

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